Understanding Biofuels Economic Impact Claims

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Introduction

A recent Iowa Renewable Fuels Association (RFA) report found that Iowa's ethanol industry created 46,937 jobs and $7.315 billion in state product.[1] It would be wonderful if this apparently booming industry really created all those jobs and accounted for such a huge fraction of state economic product, but it did not.

This report evaluates portions of the RFA report regarding job growth and domestic product effects concerning ethanol industry operations in Iowa – the claim of 46,937 created jobs. It shows that the overall net gains in economic activity in Iowa are much lower than reported in that study. This review first looks at the operational estimates and then separately the assumptions used for the construction effects.

Local, state, and national public policies, incentives, and subsidies are currently allocated based on an expectation of net gains to regional fortunes. The RFA study and others like it entice conclusions about the economic gains to regions that are unwarranted, however. There is confusion about, if not an odd fusion of, statistics that are used for promotion and statistics that are used to justify sound public decision making. If public resources are allocated on the basis of misleading or exaggerated expectations of economic gain that will not materialize, then public resources will have been squandered and the competing alternative uses to which those public resources could have been put will have been thwarted.

Here is the gap in estimates: Our sponsored research at Iowa State University leads us to conclude that, on the plant operation side only and considering all relevant likely economic impacts, there was the equivalent of 28 ethanol plants in 2006 that processed at least 600 million bushels of corn. We estimated that those plants produced 1.62 billion gallons of ethanol, and in so doing required 1,100 jobs at the ethanol plants leading ultimately to a total bump of from 4,100 to 4,700 jobs in the whole Iowa economy. The accompanying table contains those estimates.

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[1] Urbanchuck, John. Contribution of the Biofuels Indsutry to the Economy of Iowa. Prepared for the Iowa Renewable Fuels Association. February, 2007. That study combines both ethanol and soy-diesel in its analysis. This review only addresses the ethanol side of that report.

Table 1

Corn Usage and Ethanol Plant Impacts

	600 million bushels (2006)
Plants	28
Jobs at the plants	1,100
Total jobs (including plant jobs)	4,100 to 4,700
Ethanol production (million gallons)	1,620

The Iowa RFA report indicates that there were 27,025 jobs in 2006 in the ethanol production side of this process (excluding construction jobs); over 22,300 more than we estimate. The gap between the two estimates, just on the ethanol operations side, is immense. The next sections explain the difference.

1. Deconstructing the operational estimates: understanding final demand multipliers

The Iowa Renewable Fuels Association research was conducted using sets of final demand, *RIMS II*, multipliers generated at the U.S. Bureau of Economic Analysis. Final demand means that either the industry is producing for final consumption by households and institutions within the region or it is producing for consumption by entities external to the region of production. It is safe to assume here that the vast majority of new ethanol production in Iowa is geared towards export sales. On the surface, then, the use of a final demand multiplier would seem to make sense.

The initial assumption in the use of a final demand multiplier and its interpretation, however, is that expansion in industrial production like ethanol creates, concomitantly and at a fixed rate, expansion in all inter-industrial relations that industry has with its suppliers. So, the use of a final demand multiplier for a particular industry, like the organic chemical industry[2] assumes that as that industry expands production, there are fixed-ratio expansions in all industries that supply it. Hence, there is a fundamental flaw in the use of the RIMS II multipliers by the study authors in

[2] The dry-mill ethanol industry is properly classified as a type of organic chemical manufacturing. As this industry is very new, however, national input-output tables do not reflect the production characteristics of modern dry mill plants. Consequently, this research applies multipliers to key inputs into production as a substitute for a reliable organic chemicals industry multiplier.

the case of corn ethanol production. They apply it to elements of the production process for biofuels that are not contributing to satisfying a difference in final demand for that commodity; namely, for corn.

Corn in Iowa historically had three uses: it was sold to industry as an intermediate input into production, like feed mills; it was fed to animals, again as an intermediate input into livestock production; and it was exported to satisfy external demands (or final demand). By creating ethanol plants in Iowa, corn that had gone to export-based final demand is now being converted into an intermediate input into ethanol production. Value is added to that input, but the overall nature of the corn input did not change – there is no net new contribution of corn production to final demand.

As a consequence, the application of a final demand multiplier to the corn sector is spurious. Those jobs already existed and would have existed had there not been an expansion in Iowa ethanol facilities. The ethanol plant did not create the corn production jobs or all of that industry's up-stream supply linkages. To claim them as ostensibly having been created by the emerging ethanol industry is disingenuous and grossly misleading when a full two-thirds of the "created" ethanol impact jobs were already here.

That leads to our first adjustment: from the 27,205 total jobs attributed to Iowa's ethanol industry operations in the RFA report we subtract the 18,398 jobs that are linked to the state's existing corn production sector.

> **Adjustment 1:**
> **27,205 initial ethanol job impacts – 18,398 existing corn related job impacts = 8,807 jobs**

That leaves 8,807 jobs in the Iowa economy that possibly could have been created or otherwise stimulated by expansion of ethanol production.

Next we can look at the each of the several other items of inputs into production into this industry that are listed by the study authors after the already discounted corn values. First, and very notable, the Iowa ethanol industry requires a large amount of natural gas, electricity, and water, $452.4 million worth according to the study. The job gains attributable to these three industries combined represent 2,591 of the remaining 8,807 potential ethanol economic impact jobs.

All three of these, however, are massive, declining cost industries where the average cost of delivering their respective commodities up to capacity decline sharply. As a consequence, an industry that is an extremely heavy, and therefore easy to supply, user of a particular commodity is delivered that commodity at a substantially reduced price to reflect those distributional efficiencies. Large users of utilities do not stimulate average job multiplier effects –they stimulate much lower effects. This is a fundamental flaw in RIMS II-type impact analysis and one of the reasons that experienced

analysts often conduct fact checks and conduct additional secondary research before reporting a statistic.

An analogy of scale economies presents itself readily in the ethanol industry itself. A 50 million gallon per year (MGY) ethanol plant in Iowa requires 35 jobs. A 100 MGY per year plant only requires 45 jobs. The plant increases its output by 100 percent, but its job needs only go up by 28.5 percent. In point of fact, basic utilities operate on much greater scale economies than an ethanol plant, so one would expect very small job gains in those industries due to ethanol plant demands.

As part of the research that we conducted at Iowa State University on the potential economic impacts of a biofuels ethanol plant, phone calls were made to water, natural gas distributors, and rural electric cooperative professionals to ascertain the potential job growth that a large, single industry demand of their respective commodities would yield. In all instances, the amount reported by those professionals was a 10th or less than the amount assumed in our modeling systems[3]. Based on that research and on fundamental scale economy dynamics it would not be unreasonable or uncharitable to assume that the marginal job gains from all new utility related activities were no greater than 25 percent of the values reported in the table, the lower estimates of the utility professionals notwithstanding. If that were so, we would reduce the utility job impacts to 648 jobs.

Adjustment 2:
That leaves us with 8,807 – 2,591 + 648 = 6,864 potential jobs created by Iowa's ethanol industry.

Next we need to look at the reasonableness of the transportation assumptions creating 1,442 jobs. Iowa's corn historically was hauled to a mill, to a livestock feeder, or out of state. After processing in an ethanol refinery, the amount of weight that must be hauled is substantially the same as it had been when the corn was simply exported.[4] We can allow for a modicum of new rail capacity, new rail transport needs, and some shifting in local transportation, however. Like the corn statistic at the start of this section, we have to conclude that nearly all of the transportation had already existed, although we can allow for some transportation shifting. Consequently, it might not be unreasonable or uncharitable to allow for a 25 percent bump in net new transportation demand to the region (considering of course a substantial realignment from grain hoppers to ethanol tankers). That would lower our 1,442 jobs to 361 net new transportation jobs.

[3] Swenson, David and Liesl Eathington. "Determining the Regional Economic Values of Ethanol Production in Iowa Considering Different Levels of Local Investment," Bioeconomy Working Group, College of Agriculture, September 2006

[4] As a rule, out of the original corn weight, a third is ethanol, a third distillers' grains, and a third carbon dioxide. Reports recently indicate that many plants are venting their carbon dioxide as there is a glut of supply regionally so the overall weight is probably less than the original corn.

Adjustment 3:
That leaves us with 6,864 – 1,442 + 361 = 5,782 potential jobs created by Iowa's ethanol industry.

There are several categories of inputs that are incontrovertible and would be expected to in fact be new regional indirect industrial demand that was linked linearly to ethanol plant operations. New ethanol plants will require substantial maintenance and repair services; they will help to stimulate demand for a variety of financial business services, to include banking, accounting, insurance, and other important activities; and they do require a new schedule of industrial chemical inputs into the production process, primarily yeasts, enzymes, and other critical chemicals. For the time being, we can conclude that the assumptions in the report about those inputs and their concomitant output multipliers are fairly reasonable.

There is a fundamental question, though, about the likelihood of the bump in petroleum refinery inputs that the report claims. In all, when one looks at a modern ethanol plant's production recipe, one does not identify a set of refined petroleum product inputs. Their energy demands are met overwhelmingly by natural gas and electricity.

The organic chemicals industry, the industry that manufactures such diverse commodities as acetone to nail polish to tear gas along with dozens of others, however, does have strong linkages to refined petroleum products. The assumption that modern Iowa corn ethanol dry mill operation buys $84.4 million in refined petroleum products as stated in the study is, however, not correct. It is especially dubious because by our separate assessment Iowa's refineries made just $48.7 million in total sales across the whole state of Iowa and only needed 13 jobs to make those sales. It seems quite appropriate, then to reject the assertion that 351 refinery related jobs are created in Iowa.

Adjustment 4:
That leaves us with 5,782 – 351 = 5,431 potential jobs created by Iowa's ethanol industry.

This last number is probably a reasonably close estimate of the jobs linked to Iowa's ethanol industry and its other wet corn milling operations, which were substantially already in existence in the state and produce a variety of non-ethanol products like corn sweeteners.

The Renewable Fuels Association report indicated that the operational side of ethanol production in Iowa "… support[s] 27,200 jobs (p. 4).)" After deconstructing the author's procedures and assumptions, however, it is more likely that somewhere around 5,431 total jobs in Iowa can be attributed to ethanol and other corn processing production for final demand sales.

2. Deconstructing the estimates of gross domestic product

Just on the ethanol production side, the RFA report claims $5,607.3 billion in Iowa gross domestic product (or gross state product) from $10.272 billion in total output. The authors assume that, on average, across all industries, 55 percent of gross sales represent becomes gross domestic product and 45 percent of gross sales represent all intermediate inputs.

The accompanying table was generated from the 2004 data for the state of Iowa that were contained in the ImPlan data base purchased annually and maintained by Iowa State University. That data set is a complete accounting of all inter-industrial activity in the state, and it is constructed from data supplied in large part from the U.S. Bureau of Economic Analysis. It lists value added, which is the same statistic as domestic product for an industry. It shows that the 55 percent across the board assumption of domestic product generation is too high. The average for all Iowa industries in 2004 was 49 percent, and the average ranged from a low of 19 percent for total retail sales to a high of 67 percent for mining, utilities, and real estate. The average for manufacturing, within which ethanol production is classified, is 26 percent. The average from the construction industry is 44 percent. An across the board average of 55 percent is clearly not warranted.

Table 2

Value Added as a Percentage of Total Industrial Output: Iowa 2004

All agriculture	38%
Mining	67%
Utilities	67%
Construction	44%
Manufacturing	26%
Wholesale Trade	19%
Transportation & Warehousing	55%
Retail trade	19%
Information	43%
Finance & insurance	58%
Real estate & rental	67%
Professional- scientific & tech svcs	58%
Management of companies	56%
Administrative & waste services	53%
Educational svcs	51%
Health & social services	60%
Arts- entertainment & recreation	61%
Accomodation & food services	44%
Other services	48%
All Industries	49%

Based on this table and on the overstatements in the allocation of jobs listed in the previous section, one should also reject the claims of gross domestic product contribution listed in the report.

3. Deconstructing the construction effects

Again, just on the ethanol side, the RFA report asserts that 19,733 job economic impacts are annually attributable to plant construction in Iowa. Out of that they estimate $1.996 billion in state GDP from construction. The authors note that construction jobs are temporary, but yet they infer that these values can be annualized and added to the operational statistics and reported them as if they were to be considered ongoing.

As a general rule, regional economists never combine a declaration of construction effects with operational effects. They are reported separately and discussed separately from operational effects. There are reasons for that.

For one, many analysts often over-attribute construction activity to a location or to a state. These authors indicate that a third of the overall construction value of a modern ethanol plant accumulates to Iowa contractors. They, however, offer no evidence to support that contention. If we break down a modern Iowa ethanol plant we know that the land and the land preparation are likely to be purchased or bid locally, along with area ready-mix and aggregate production. Very large fractions of the engineering, architectural, specialized contracting, and the highly specialized capital, technical, and labor inputs required by modern ethanol plants do not originate in Iowa, however. It remains to be demonstrated that a full third of the capital payments for a plant stay in Iowa.

We can look for indirect evidence of construction job growth in Iowa. In analyzing growth in Iowa construction employment over the past 5 years from the U.S. Bureau of Economic Analysis (the same agency that supplies the *RIMS II* multipliers), we see that total jobs grew by 12,276 in that sector. Three-fourths of those jobs have accumulated in the category of construction called “specialty trade construction”, however, which entails primarily businesses that pour cement, finish walls, a nd do plumbing, painting, and electrical work. Total commercial building construction jobs in Iowa, the kind that would raise an ethanol plant, however, are only up by a little over 1,550 jobs. And a spatial assessment of construction job growth in Iowa through 2004 indicates that the vast majority of growth is associated with commercial and residential expansions in several of the state’s booming metropolitan regions, not areas where ethanol plants are going up.

In short there is scant evidence of net strong bumps in construction jobs in Iowa that are attributable directly to the boost in ethanol plant construction in the state. The claim that there is a short term-only boost to the state’s economy (which they report in as occurring on an annual basis) in the amount of $1.7 billion in state GDP and 19,733 total construction related job impacts is yet to be demonstrated by reliable research and is highly dubious.

Table 3. All Construction Jobs in Iowa	
2000	2005
102,170	114,446
Construction of Buildings Jobs	
2000	2005
25,006	26,560

Conclusion: where does this all leave us?

If any economic developer or state elected official were to announce that there has been a systematic gain in the state's job fortunes of from 4,100 to 4,700 jobs from 2000 through 2006, most people would have called that a great success. Further, if there were strong rates of capital formation that was supporting the state's construction industries, that also would be met with general public approval.

Iowa's biofuels industry is currently producing good jobs and good job impacts across the state. The industry is still in a growth phase. There are effects that accumulate to the state as a whole, and there are especially strong effects in many of our more rural areas that need a boost. But the net gains in state jobs and state product, what we count when we are counting our plusses, are much more modest to date than trade associations and other supporters claim.

Local and state leaders should be mindful of these differences: they are allocating literally hundreds of millions in current and future tax credits and other subsidies in support of biofuels development, but they may have a distorted sense of potential regional and statewide economic outcomes.